ISSN (print) 0093-4666 © 2010. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

DOI: 10.5248/114.115

Volume 114, pp. 115–126 *October–December 2010*

The *Entolomataceae* of the Pakaraima Mountains of Guyana 5: new species of *Alboleptonia*

T.W. Henkel*[1], M.C. Aime[2], D.L. Largent[1] & T.J. Baroni[3]

* *twh5@humboldt.edu*

[1]*Department of Biological Sciences, Humboldt State University Arcata, California, USA. 95521*

[2]*Department of Plant Pathology and Crop Physiology, Louisiana State University Agricultural Center, Baton Rouge, Louisiana, USA. 70803*

[3]*Department of Biological Sciences, State University of New York—College at Cortland, New York, USA. 13045*

Abstract—This paper is the fifth in a series documenting the *Entolomataceae* taxa (*Agaricales*, *Basidiomycota*) from Guyana. Three new species are described — *Alboleptonia angustospora*, *A. cystidiosa*, and *A. minima* — occurring in tropical rainforests of the Upper Potaro River Basin in Guyana's Pakaraima Mountains. Macromorphological, micromorphological, and habitat data are provided for each. *Alboleptonia* has not been previously reported from Guyana.

Key words—*Agaricomycotina*, fungal taxonomy, Guayana Highlands, Guiana Shield, neotropics

Introduction

Species of *Alboleptonia* Largent & R.G. Benedict are easily classified into the *Entolomataceae* (*Agaricales*) due to their dull pink basidiospores that are angular in all views. *Alboleptonia* was erected (Largent & Benedict 1970) to accommodate entolomatoid species that combine diagnostic features of the type species, *Alboleptonia sericella* (Fr.) Largent & R.G. Benedict, including a white to pale cinereous basidioma, a silky to appressed-fibrillose or minutely appressed-squamulose, opaque (NOT translucent striate), non-hygrophanous pileal surface, which microscopically is composed of an entangled layer of hyphae, unique color reactions in Ehrlich's reagent, and a low urea concentration. Also, under scanning electron microscopy *Alboleptonia* basidiospores exhibit a dihedral base and a pair of 4-angled facets on the apico-adaxial side that

results in a 5-sided apical facet (Pegler & Young, 1978). This original concept of *Alboleptonia* has subsequently been applied by Largent (1994), Baroni & Lodge (1998), Pegler (1983, 1997), and Orton (1991a, b). A recent molecular study (Co-David et al. 2009), which putatively shows *Alboleptonia* as polyphyletic, suffered from small sample size (two species) and incongruent application of generic/subgeneric concepts regarding *Alboleptonia* sensu Largent & Benedict and *Entoloma* subgen. *Alboleptonia* (Largent & R.G. Benedict) Noordel. (Noordeloos 1979, 1987, 1988, 1992, 2004).

New World tropical and subtropical species meeting the diagnostic requirements of *Alboleptonia* sensu Largent & Benedict have been found in the Lesser and Greater Antilles (Baroni & Lodge 1998; Pegler 1983), Trinidad and Venezuela (Dennis 1953, 1970), Brazil (Pegler 1997), and elsewhere in South America (Horak 1977, 1982). Over the course of several years of field expeditions in a remote region of the Pakaraima Mountains of Guyana, we have collected fungi representing at least four distinct entolomatoid taxa corresponding to *Alboleptonia* sensu Largent & Benedict, three of which are described here.

Materials and methods

Collections were made during the 2001–03, 2006, and 2009 May–July rainy seasons and the 2003 and 2009 December rainy seasons from the Upper Potaro River Basin, within a 15 km radius of a permanent base camp at 5°18'04.8"N; 59°54'40.4"W; elevation 710 m. This collecting area, located in an undulating valley approximately 20 km east of Mt. Ayanganna (2200 m), is densely forested with a mosaic of primary *Dicymbe*-dominated and mixed forests of the *Eschweilera–Licania* association (Henkel 2003). Methods for field descriptions, microscopic analyses, and image capture were those of Largent et al. (2008). Fungi were field-dried with silica gel. Color designations follow Kornerup & Wanscher (1978) with color plates noted in parentheses (e.g., 4A7). Specimens were deposited in the following herbaria: BRG, HSU, and LSUM (Holmgren et al. 1990). Microscopic structures were measured as described in Largent (1994) and Largent et al. (2008a). Statistics determined include: means of basidiospore length and width, ± standard deviations; E, the quotient of length by width indicated as a range variation in n objects measured; Q, the mean of E-values; n = number of objects measured.

Taxonomy

Alboleptonia angustospora Largent, Aime & T.W. Henkel, **sp. nov.** Fig 1

Mycobank MB 518326

Pileus 10–17 mm latus, late convexus vel plano-convexus, ad centrum depressus, albus vel eburneus, implexus appressus fibrillosus, siccus. Lamellae adnatae, sub-adnexae, vel subdecurrentes, subdistantes, albae vel roseae; margine concolori, cystidiata. Stipes 33–57

× 1–3 mm, equalis, albus, glaber, apice pruinoso. Basidiosporae 5–6-angulares, 7.3–10 × 5.1–7.6 µm. Basidia 4-sterigmata, late cylindracea, 20–34.3 × 6.6–10.4 µm. Cheilocystidia abundantes, cylindro-clavata. Pleurocystidia carentes. Pileipellis constata e intricatis hyphis. Fibulae carentes.

Type: *Aime 3159* (BRG, **holotype**; LSUM, **isotype**).

Etymology: *angustus* (L. adj.) = narrow; *-sporus* (L. adj.) = spored; referring to the narrow basidiospores.

key characters — *Alboleptonia angustospora* is easily recognized as a member of *Alboleptonia* because of its white, non-hygrophanous, non-striate, convex-depressed (occasionally umbonate), entirely matted-tomentulose to matted-fibrillose pileus and its 5–6-angled, heterodiametric basidiospores. It is unique among macromorphologically similar species of *Alboleptonia* in its combination of cylindric to cylindro-clavate, somewhat strangulated cheilocystidia, 5–6-angled, heterodiametric basidiospores that average < 9 µm long and < 7 µm broad, and the lack of pleurocystidia, clamp connections, and pigmentation.

Macrocharacters — Pileus 10–17 mm broad, 5–8 mm high, broadly convex to plano-convex with a distinct central depression occasionally with a very small, blunt umbo, entirely matted-tomentulose to matted-appressed fibrillose, chalky white to off-white to pale cream (4A1–4A2) at times with a faint hint of yellow (2A4) at disc, opaque, dry, not hygrophanous, not translucent; margin somewhat downcurved, entire but under hand lens irregularly and finely crenulate. Lamellae subclose to subdistant, adnate, subadnexed, or subdecurrent, 1.5–2.4 mm tall, chalky white, faintly pink at maturity (5A2–5A3); margin concolorous, finely eroded-cystidiate under hand lens; lamellulae 3, of different lengths. Stipe 33–57 mm × 1–3 mm, equal, glabrous, occasionally white-pruinose at apex, concolorous, yellowing with age, cartilaginous, very fragile, hollow. Basal mycelium scant, white. Odor none, pleasantly fungoid, or slightly fragrant; Taste slightly fungoid. spore deposit not obtained.

Microcharacters — Basidiospores distinctly 5–6-angled, isodiametric in polar view, subisodiametric to heterodiametric (rarely isodiametric) in profile view, 7.3–10 × 5.1–7.6 µm (mean = 8.5 ± 0.56 × 6.44 ± 0.54 µm; E = 1.1–1.68, Q = 1.33 ± 0.12, n = 104). Basidia 4-sterigmate, broadly cylindric and rounded at the base, 20–34.3 (–38.4) × 6.6–10.4 µm (mean = 28.0 ± 2.9 × 8.8 ± 0.79 µm; E = 2.3–4.2, Q = 3.1 ± 0.49; n = 29). Cheilocystidia abundant, cylindric to cylindro-clavate, many somewhat strangulated, 17.3–86.0 × 3.8–9.4 µm (mean = 46.8 ± 15.94 × 6.0 ± 1.28 µm; E = 2.15–19.13, Q = 7.72; n = 29). Pleurocystidia absent. Lamellar trama composed of parallel to subparallel, rather short hyphae, cells 44.8–145.1 × 2.4–15.9 µm. Pileipellis an entangled layer of hyphae throughout; terminal cells cylindric to cylindro-clavate, 23.4–57.1 × 5.6–11.3 µm. Pileal trama composed of entangled hyphae, cells 44.3–140.2

× 6.3–21.0 µm. Stipitipellis a cutis; hymenial clusters occasionally present; caulocystidioid elements 45.0–55.4 × 2.4–6.7 µm. Refractive hyphae scattered to abundant in the pileal trama. Refractive granules, brilliant granules, and pigmentation absent. Clamp connections absent.

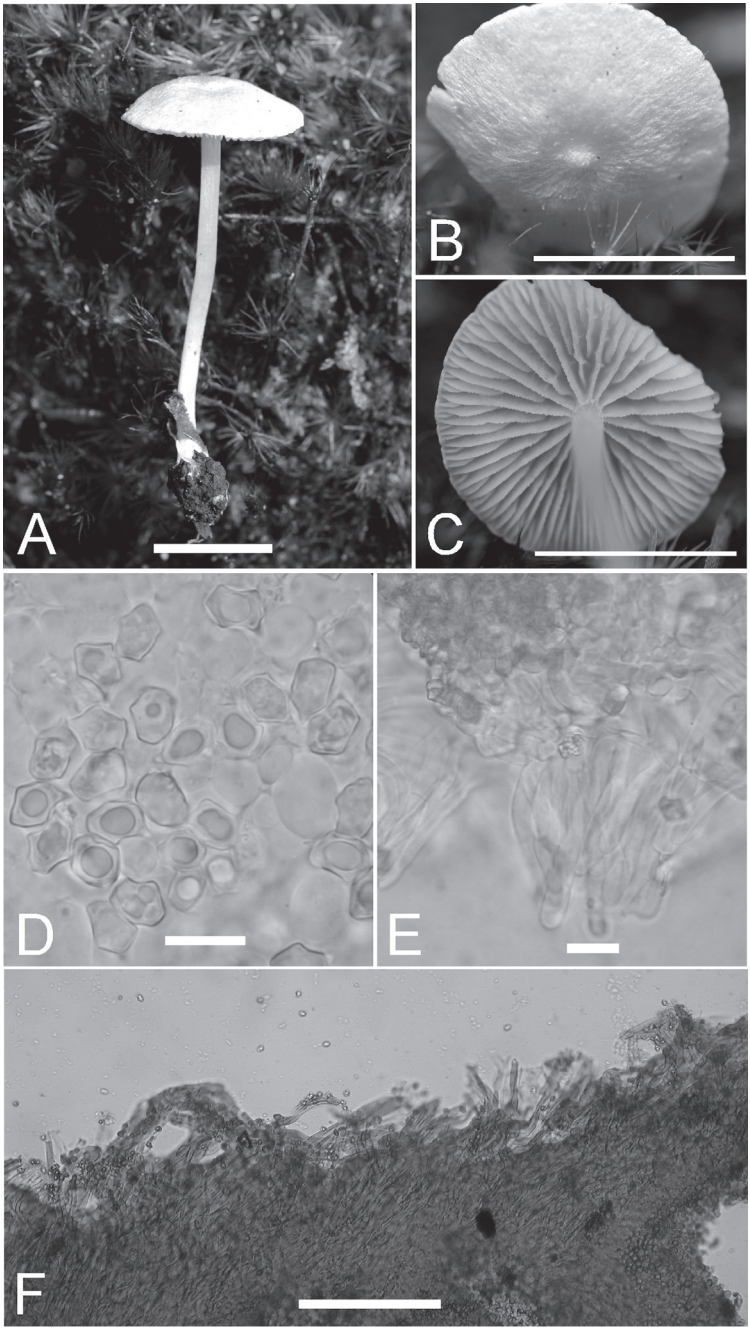
Ecology, range, distribution — Solitary on humic mat on forest floor or clay soil in mixed *Dicymb*e spp. forest, known only from the Upper Potaro River Basin of Guyana.

Representative specimens examined. **Guyana.** Region 8: Potaro-Siparuni. Pakaraima Mountains. Upper Potaro River Basin, 15–20 km east of Mt. Ayanganna, environs of base camp located on Potaro River one km upstream from confluence with Whitewater Creek at 5°18′04.8″N, 59°54′40.4″W, elevation 710–750 m: vicinity of base camp, 11 May 2001, *Henkel 8095* (BRG; HSU); 2.5 km southeast of base camp, *Dicymbe* plot 2 in humic mat, 12 June 2002, *Aime 1978* (BRG; LSUM); 0.5 km west of base camp, in *Dicymbe* forest, 29 June 2002, *Aime 2161* (BRG; LSUM); 1 km southeast of base camp on Benny's ridge in clay soil, 2 July 2006, *Aime 3159* (BRG, **holotype**; LSUM, **isotype**); vicinity of Tadang Creek base camp, 29 December 2009, *Henkel 9148* (BRG; HSU).

Comments — *Alboleptonia angustospora* resembles a group of species including *Entoloma parasericellum* Corner & E. Horak , *E. neosericellum* E. Horak, *E. subsericellum* Murrill, *E. peralbidum* Horak, *E. percandidum* Noordel., and *E. hololeucum* (Singer) E. Horak. *Alboleptonia angustospora* can be separated from this group of species by a combination of the following characters: cylindric to cylindro-clavate cheilocystidia, 5–6-angled, heterodiametric basidiospores that average < 9 µm in length and < 7 µm in width, and the lack of pleurocystidia, clamp connections, and pigmentation.

In Guyana, *A. angustospora* may be confused with *Alboleptonia minima* and *A. cystidiosa* (described here) as each of these species has a white basidioma with an appressed-fibrillose, opaque, non-translucent striate pileus, similarly shaped and sized basidiospores, and lacks clamp connections. *Alboleptonia minima* can be separated from *A. angustospora* by its small pileus (< 10 mm broad) and somewhat longer stipe (both of which lack cream or yellowish tones), dense tomentose basal mycelium, and anatomically similar stipitipellis, pileipellis, and lamellar edges that include non-strangulated cheilocystidia. *Alboleptonia cystidiosa* is distinct from *A. angustospora* due to its cylindro-clavate caulocystidia, clavate to obclavate cheilocystidia and pleurocystidia, and weakly acrid taste. In Guyana, several other as yet unidentified white entolomatoid species superficially resemble *A. angustospora*. However these taxa either have differently shaped basidiospores and/or a different pileipellis structure compared to *A. angustospora* (Henkel & Aime unpubl. data).

Fig. 1. Macro- and microscopic features of *Alboleptonia angustospora* (BRG holotype Aime 3159). A. Basidioma. B. Matted-fibrillose pileus surface with umbo. C. Lamellae with cystidiate margins. Bar = 10 mm. D. Basidiospores. E. Cheilocystidia. Bar = 10 µm. F. Pileus surface in longitudinal section. Bar = 100 µm.


A
B
C
D
E
F

Alboleptonia earlei (Murrill) Largent & R.G. Benedict from Cuba and Costa Rica (Baroni & Lodge, 1998) is the only other neotropical *Alboleptonia* species known that lacks clamp connections and has basidiospores similar in size (7–9 × 5.5–6.5 µm) and shape to those of *A. angustospora*. *Alboleptonia earlei* can be differentiated by its lack of cheilocystidia and garlic or onion odor (Largent & Benedict 1970; Baroni & Lodge 1998).

Among Old World alboleptonioid fungi, *Entoloma inficetum* Corner & E. Horak from the Solomon Islands has many of the same characteristics as *Alboleptonia angustospora*. However, *E. inficetum* has a smooth pileus with an entirely repent pileipellis and cheilocystidia with a yellowish, protoplasmic pigment; in *A. angustospora*, the pileus is consistently matted-fibrillose to matted-tomentose, the pileipellis is an entangled hyphal layer that is never repent, and the cheilocystidia lack pigment (Horak 1980).

Alboleptonia cystidiosa Largent & Aime, **sp. nov.** FIG 2

MYCOBANK MB 518327

Pileus 8–35 mm latus, convexus vel plano-convexus, albus, cinereo humili umbone centrum occupanti, radiatim appressus fibrillosus. Lamellae adnatae, concolores. Stipes 25–48 × 2.5–7 mm, concolor. Basidiosporae 5–6-angulares, 7.6–9.8 × 5.3–8.4 µm. Basidia 2 vel 4-sterigmatae, clavatae, 28–38.2 × 7.6–10.7 µm. Cheilocystidia et pleurocystidia abundantes, obclavata. Pileipellis constata e intricatis hyphis. Fibulae carentes.

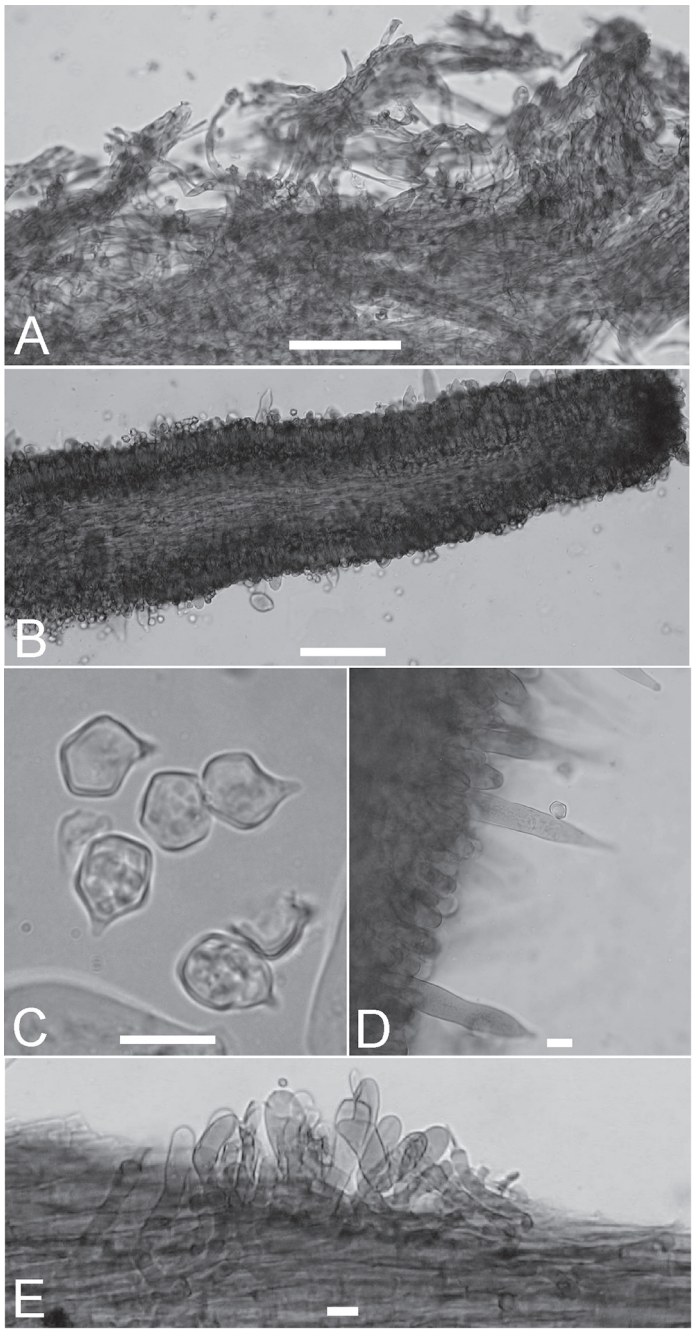
TYPE: *Aime 2395* (BRG, **holotype**; LSUM, **isotype**).

ETYMOLOGY: *cystidiosus* (L. adj.) referring to the abundant hymenial cystidia.

KEY CHARACTERS — *Alboleptonia cystidiosa* is unique in its combination of a convex pileus with a rounded to flattened grayish umbo, slightly acrid taste, small, heterodiametric basidiospores, abundant clavate to obclavate cheilocystidia and pleurocystidia, cylindro-clavate to clavate caulocystidia, and lack of clamp connections.

MACROCHARACTERS — PILEUS 8–35 mm broad, narrowly convex to broadly convex to nearly plane but wavy with age, chalky white with a greyish, low flattened umbo; appearing glabrous, under hand lens radially fibrillose, scurfy over umbo; margin entire, finely eroded with age; trama very thin, < 1 mm over stipe. LAMELLAE close, adnate, thin, narrow, < 1 mm tall, white, faintly pink at maturity, occasionally forking near margin; lamellulae 4–6, of different lengths. STIPE 25–48 × 2.5–7.0 mm, slightly broader and flattened towards base, chalky white, glabrous, finely longitudinally striate under handlens; context white, unchanging, hollow. BASAL MYCELIUM lacking. ODOR faint, indistinct; TASTE slightly acrid. SPORE DEPOSIT salmon pink (7B4).

FIG. 2. Microscopic features of *Alboleptonia cystidiosa* (BRG HOLOTYPE Aime 2395). A. Pileus surface in longitudinal section. B. Lamellar section showing abundant pleurocystidia. Bar = 100 µm. C. Basidiospores. D. Cheilocystidia. E. Caulocystidia near stipe apex. Bar = 10 µm.


A
B
C
D
E

Microcharacters — Basidiospores distinctly 5–6-angled, isodiametric in polar view, subisodiametric to heterodiametric in profile view, rarely isodiametric, 7.6–9.8 × 5.3–8.4 µm, (mean = 8.88 ± 0.53 × 6.92 ± 0.72 µm, E = 1.09–1.56, Q = 1.29 ± 0.1; n = 28). Basidia clavate, 2 or 4-sterigmate, 28.0–38.2 × 7.6–10.7 µm, (E = 3.07–4.72, Q = 3.7 ± 0.38; n = 13). Cheilocystidia abundant, obclavate, occasionally clavate, hyaline, 36.0–129.0 × 8.8–15.4 µm. Pleurocystidia abundant, similar in shape to but smaller than the cheilocystidia, hyaline, 47.2–86.6 × 10.0–15.84 µm. Pileipellis an entangled layer of cylindric hyphae throughout. Pileocystidia clavate to cylindro-clavate, 20.5–50.9 × 4.5–15.7 µm. Caulocystidia in scattered but abundant clusters, cylindro-clavate to clavate to broadly clavate, 17.3–59.1 × 5.3–19.3 µm. Refractive hyphae scattered in the pileus and stipe tramas. Refractive granules, brilliant granules, and pigmentation absent. Clamp connections absent.

Ecology, range, distribution — Clustered on sandy soils in mixed riverine forest, known only from the Upper Potaro River Basin of Guyana.

Representative specimens examined. **Guyana.** Region 8: Potaro-Siparuni. Pakaraima Mountains. Upper Potaro River Basin, ~15 km east of Mt. Ayanganna, environs of Ayanganna airstrip, elevation ~720 m: on trail between airstrip and Potaro River in sandy soil, 29 December 2003, *Aime 2395* (BRG, **holotype**; LSUM, **isotype**).

Comments — *Alboleptonia cystidiosa* is similar to the pantropical *Alboleptonia stylophora* (Berk. & Broome) Pegler and *Entoloma niveum* G. Stev. from New Zealand in possessing a white, umbonate pileus that is non-hygrophanous and non-striate, cheilocystidia, and an absence of clamp connections. *Alboleptonia stylophora* can be distinguished from *A. cystidiosa* by its cuspidate pileus that tends to develop yellowish hues, cylindro-clavate cheilocystidia, lack of pleurocystidia, and considerably larger basidiospores (9.3–13.8 × 7.7–9.7 µm; Baroni & Lodge, 1998). *Entoloma niveum* differs from *A. cystidiosa* in its papillate pileus, farinaceous odor, strangulated cheilocystidia, and lack of pleurocystidia (Horak 1973, 2008). *Entoloma neosericellum* from New Zealand resembles *A. cystidiosa* in having a white, innately fibrillose pileus, cheilocystidia and pleurocystidia, and an absence of clamp connections. *Entoloma neosericellum* is nonetheless easily separated from *A. cystidiosa* by its ventricose-rostrate pleurocystidia, larger basidiospores (10–11.5 × 7.5–8.5 µm), and hygrophanous, translucent-striate, non-umbonate pileus (Horak 2008).

Alboleptonia minima Largent & T.W. Henkel, **sp. nov.** Fig 3

Mycobank MB 518328

Pileus 7–8 mm latus, late convexus vel planus, ad centrum depressus, albus, minute appressus-fibrillosus. Lamellae adnatae, confertae, albae vel roseae. Stipes 50–56 × 2–3 mm, apicem versus leviter contractus, albus, apice pruinosus. Basidiosporae 6-angulares, 7.5–9.1 × 5.8–7.4 µm. Basidia 4-sterigmata, clavata, 24.3–31.7 × 7.2–9.5 µm. Cheilocystidia abundantes, cylindro-clavata. Pleurocystidia carentes. Pileipellis constata e intricatis hyphis sub-erectis terminalibus cellulis. Fibulae carentes.

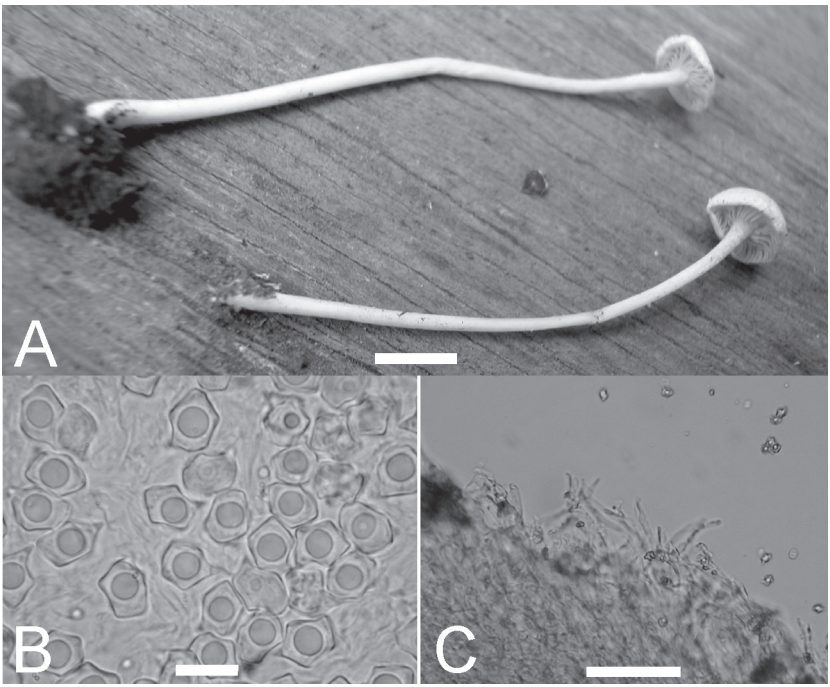


Fig. 3. Macro- and microscopic features of *Alboleptonia minima* (BRG holotype Henkel 9037). A. Basidiomata. Bar = 10 mm. B. Basidiospores. C. Pileipellis with sub-erect terminal elements. Bar = 10 µm.

Type: *Henkel 9037* (BRG, **holotype**; HSU, **isotype**).

Etymology: *minimus* (L. adj.) = very small or tiny, referring to the width of the pileus.

key characters — *Alboleptonia minima* is distinguished by its white basidioma with a depressed < 10 mm broad pileus, narrow, relatively long stipe, lack of clamp connections, and a stipitipellis, pileipellis, and lamellar edges composed of an entangled layer of hyphae.

Macrocharacters — Pileus 7–8 mm broad, 1–2 mm high, broadly convex to plane with a broad central depression, white, minutely appressed-fibrillose, opaque, not translucent, not hygrophanous; margin decurved to nearly plane, entire. Lamellae 2–3 mm long, 1 mm tall, white at first, faintly pink with age, adnate, close; margin minutely fringed under hand lens; lamellulae not recorded. Stipe 50–56 × 2–3 mm, enlarging slightly toward base, white, minutely pruinose at the apex and minutely fibrillose elsewhere, hollow. Basal mycelium a moderately dense white tomentum. Taste, odor, and spore deposit not recorded.

Microcharacters — Basidiospores distinctly 6-angled, isodiametric in polar view, subisodiametric or more often heterodiametric in profile view, apex typically rounded and triangular, 7.5–9.1 × 5.8–7.4 µm (mean = 8.5 ± 0.4 × 6.6 ± 0.5 µm; E = 1.15–1.47, Q = 1.29 ± 0.1; n = 28). Basidia 4-sterigmate, clavate, distinctly tapered downward, 24.3–31.7 × 7.2–9.5 µm (mean = 28.1 ± 2.4 × 8.61 ± 0.6 µm; E = 2.66–3.95; Q = 3.27 ± 0.3; n = 14). Lamellar edge a sterile layer of entangled hyphae. Cheilocystidia abundant, cylindric to cylindro-clavate, 31.1–47.6 × 3.8–5.5 µm. Pleurocystidia absent. Lamellar trama subparallel, of relatively short and narrow hyphae, cells 48.9–87.5 × 3.0–4.3 µm. Pileipellis an entangled layer of hyphae with semi-erect terminal cells, particularly over disc. pileocystidia cylindric to narrowly cylindro-clavate, 21.5–38.9 × 2.8–8.3 µm. Pileus trama composed of interwoven hyphae, cells 68.0–110.9 × 7.0–10.4 µm. Stipitipellis an entangled hyphal layer. Caulocystidia similar in size and shape to the cheilocystidia. Refractive hyphae abundant in the subhymenium and pileus trama adjacent to lamellae, yellowish in 3% KOH, apparently absent in the lamellar trama. Refractive granules, brilliant granules, and pigmentation absent. Clamp connections absent.

Ecology, range, distribution — Scattered on humus of forest floor in *Dicymbe* forest, known only from the Upper Potaro River Basin of Guyana.

Representative specimens examined. **Guyana.** Region 8: Potaro-Siparuni. Pakaraima Mountains. Upper Potaro River Basin, 15–20 km east of Mt. Ayanganna, environs of base camp located on Potaro River one km upstream from confluence with Whitewater Creek at 5°18′04.8″N, 59°54′40.4″W, elevation 710–750 m: in *Dicymbe* plot 2, 11 July 2009, *Henkel 9037* (BRG, **holotype**; HSU, **isotype**).

Comments — *Alboleptonia minima* is unique among entolomatoid fungi worldwide because of its white basidioma with a depressed pileus < 10 mm broad, narrow, relatively long stipe, and a stipitipellis, pileipellis, and lamellar edge composed of a similarly entangled layer of hyphae. Although *Rhodophyllus pilosellus* Romagn. & Gilles from Gabon shares a number of features with *A. minima*, it can be differentiated by its strongly fibrillose to flocculose pileus and its broader (11–17 µm) cheilocystidia that are covered over their apices with a hyaline, resinous substance (Romagnesi & Gilles 1979).

Acknowledgments

This research was made possible by grants from the National Geographic Society's Committee for Research and Exploration and NSF DEB-0918591 to TWH and by an Explorer's Club Exploration and Field Research Grant to MCA. Mimi Chin, C. Andrew, V. Joseph, F. Edmond, and L. Edmond provided field assistance in Guyana. Christian Feuillet provided Latin translations. Research permits were granted by the Guyana Environmental Protection Agency. This paper is number 168 in the Smithsonian Institution's Biological Diversity of the Guiana Shield Program publication series. Our

special thanks go to Drs. A. Methven and J.L. Mata for their critical comments and revisions.

Literature cited

Baroni TJ, DJ Lodge. 1998. *Alboleptonia* from the Greater Antilles. Mycologia 90: 680–696. doi:10.2307/3761227

Co-David C, Langeveld D, Noordeloos ME. 2009. Molecular phylogeny and spore evolution of *Entolomataceae*. Persoonia 23: 147–176. doi:10.3767/003158509X480944

Dennis RWG. 1953. Les Agaricales de l'Ile de la Trinité. *Rhodosporae-Ochrosporae*. Bulletinde la Société Mycologique de France 69: 145–198.

Dennis RWG. 1970. Fungus Flora of Venezuela and adjacent countries. Kew Bulletin Additional Series 3: 1–531.

Henkel TW. 2003. Monodominance in the ectomycorrhizal *Dicymbe corymbosa* (*Caesalpiniaceae*) in Guyana. Journal of Tropical Ecology 19: 417–437. doi: 10.1017/S0266467403003468

Holmgren PK, Holmgren NH, Barnett LC. 1990. Index Herbariorum I: the herbaria of the world. Regnum Vegetabile 120: 1–693.

Horak E. 1973. Fungi Agaricini Novaezelandiae I–V. Beihefte Nova Hedwigia 43: 1–200.

Horak E. 1977. *Entoloma* in South America I. Sydowia 30: 40–111.

Horak E. 1980. *Entoloma* (*Agaricales*) in Indomalaya and Australasia. Beihefte Nova Hedwigia 65: 1–352.

Horak E. 1982. *Entoloma* in South America II. Sydowia 35: 75–99.

Horak E. 2008. *Agaricales* of New Zealand 1: *Pluteaceae* (*Pluteus*, *Volvariella*), *Entolomataceae* (*Claudopus*, *Clitopilus*, *Entoloma*, *Pouzarella*, *Rhodocybe*, *Richoniella*). Fungi of New Zealand Volume 5. Hong Kong, Fungal Diversity Press..

Kornerup A, Wanscher JH. 1978. Methuen handbook of colour. 3rd ed. Chichester, Richard Clay Ltd.

Largent DL. 1994. Entolomatoid Fungi of the Western United States and Alaska. Eureka, Mad River Press Inc.

Largent DL, Benedict RG. 1970. Studies in the rhodophylloid fungi II: *Alboleptonia*, a new genus. Mycologia 62: 437–452. doi:10.2307/3757517

Largent DL, Henkel TW, Aime MC, Baroni TJ. 2008. The *Entolomataceae* of the Pakaraima Mountains of Guyana I: four new species of *Entoloma* s. str. Mycologia 100: 132–140. doi:10.3852/mycologia.100.1.132

Noordeloos ME. 1979. Type studies in the Entolomatoid fungi in the Velenovsky herbarium I. Species described in the genera *Nolanea*, *Leptonia*, and *Telamonia*. Persoonia 10: 245–265.

Noordeloos ME. 1987. *Entoloma* (*Agaricales*) in Europe. Synopsis and keys to all species and a monograph of the subgenera *Trichopilus*, *Inocephalus*, *Alboleptonia*, *Leptonia*, *Paraleptonia*, and *Omphaliopsis*. Beihefte Nova Hedwigia 91: 1–419.

Noordeloos ME. 1988. Entolomataceae Kotl. & P. 77–177, in C Bas et al. (eds.), Flora Agaricina Neerlandica Vol. 1. 1998 second printing. Rotterdam, A. A. Balkema.

Noordeloos ME. 1992. *Entoloma* s. l. Fungi Europaei 5: 1–760.

Noordeloos ME. 2004. *Entoloma* s. l. Fungi Europaei 5a: 761–1378.

Orton PD. 1991a. A revised list of the British species of *Entoloma* sensu lato. Mycologist 5: 123–138. doi:10.1016/S0269-915X(09)80307-8

Orton PD. 1991b. A revised list of the British species of *Entoloma* sensu lato. Mycologist 5: 172–176. doi:10.1016/S0269-915X(09)80478-3

Pegler DN. 1983. Agaric Flora of the Lesser Antilles. Kew Bulletin Additional Series 9: 1–668.
Pegler DN. 1997. The Agarics of São Paulo, Brazil. London, Royal Botanic Garden Kew.
Pegler DN, Young TK. 1978. *Entolomataceae* Kotl. & Pouz. World Pollen Spore Flora 7: 1–32.
Romagnesi H., Gilles G. 1979. Les Rhodophylles des forêts côtières du Gabon et de la Côte d'Ivoire avec une introduction générale sur la taxonomie du genre. Beihefte Nova Hedwigia 59: 1–649.